

MML TM 94-06

# COLLOCATED TUNABLE WAVENUMBER SENSOR/ACTUATORS FOR SMART STRUCTURES

N00014-92-C-0214

CDRL A001.17

Covering the period: 1 February to 28 February 1994

Accesion For

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Justification

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Submitted to:

Office of Naval Research Scientific Officer Code: 1221

Submitted by:

K. Bridger L. Jones

### MARTIN MARIETTA CORPORATION

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March 8, 1994

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Approved for puche released
Distribution Unlimited

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### Contract progress and activities since CDRL A001.16.

### Summary of progress

- One actuator module from the last burnout was sintered. It is intact but has some minor cracks. Three
  other actuators (two with Pt electrodes and one with Au/Pt/Pd electrodes) were burned out and are ready
  to be CIPped and sintered.
- Another batch of tape was cast with a 36% volume fraction of binder. Two actuators were made and put into burnout.
- An actuator (6-65-1) was tested at 3000 psi (to 0.8 MV/m) over the temperature range (-10°C to 40°C). At 5°C, the average strain of the actuator was 460 µstrain.

### Telephone calls, trips, and significant results

 Bridger briefed Commander Colvert (PEO, AAASMP) on the use of PMN in transducers. Data from this contract were included and acknowledged.

### Results bearing on prior problem areas

None

### Programmatic changes

None

### Technical or scheduling problem areas

 There was a slight delay in CIPping the large actuators due to a problem with the bags leaking during CIPping. The problem was addressed and should be resolved following receipt of larger CIPping bags.

### Contract and cost schedule status

- Expended funds as of 28 February 1994, including expenditures prior to 23 July, were \$232K against a current budget of \$250K.
- A revised cost schedule, beginning at the 23 July program restart, and reflecting the \$114K funding gap
  is attached.

### Plans for March 1994

- The three actuator modules from the last burnout will be CIPped and then sintered at a slower rate (10°C/min to 900°C, 5°C/min to 1200°C, 3 hour hold, 1°C/min to 500°C).
- The two actuator modules in burnout will be CIPped and sintered (the sintering schedule may be modified based on the results of the next sintered modules).

**Preparers** 

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## SCHEDULE, MILESTONES, AND DELIVERABLES -- Updated March 5, 1994

Phase I	1993						1994					
	J	Α	S	0	N	D	J	F	М	Α	М	J
CONTRACT START	•											
Task 1: Materials Preparation and Device Design												
Purchase additional starting materials	4											
Formulate ceramic materials												
Materials characterization		ı					,					
• Model										}		
Task 2: Module Fabrication												
Prepare multilayer devices									->			
Burnout, isopress, and fire devices						5				>		
Polish and terminate devices										->		
Task 3: Device Testing												
Initial electrical characterization			-				5			$\overline{}$		
Initial mechanical characterization										- 11	$\Rightarrow$	10.11
Force/displacement versus field and prestress									5		<b>—</b>	
Strain versus field									5		<b></b>	
• (Hipotting)									5			->
Reliability testing (extended cycling)												⊸
Final "proof" characterization											1	→
DELIVERABLES												
REPORT											7	<u></u>
	J	Α	S	0	N	D	J	F	М	Α	М	J

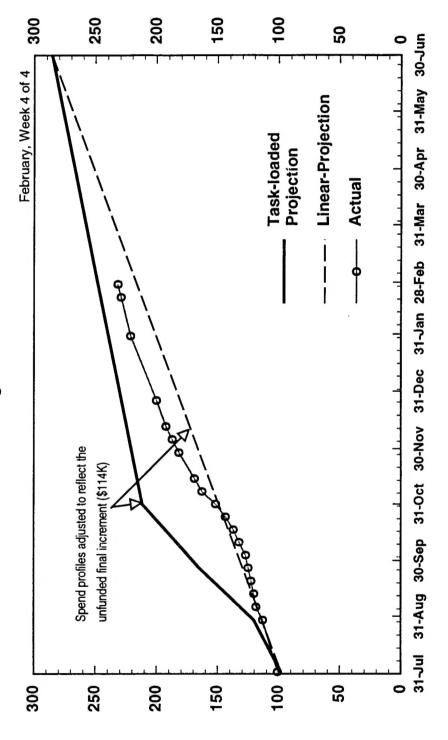
KEY:	
Milestone:	Δ
Planned task:	
Completed task:	
Task with new projected completion:	

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Mar 8, 1994

# **EXPENDITURE CHART**

3117-000 ONR Co-Fired High-Force Actuators



АМООИТ ЕХРЕИВЕВ (\$К)

**AMOUNT EXPENDED (\$K)**